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Regulation of Microfinance Institutions in Developing countries: an incentives theory approach

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Abstract

We analyze the optimal policy of regulation of microfinance institutions in developing countries, where investment funds are insured by the government and customer deposits. We used a mixed model, combining adverse selection and moral hazard to characterize a class of optimal incentive schemes applied in presence of government funds and in non-government funded. We also analyse the effects of prudential regulation of deposits on the profitability of MFI and social welfare, and we compare prudential and non-prudential regulation. The incentive scheme that we propose can be regarded as a "smart subsidy" mechanism that contributes to the economic and social development.

Keywords: Microfinance, adverse selection, moral hazard, incentive mechanisms, regulation, smart subsidy.

JEL : G10, G21, G28

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1. Introduction

In the most part of developing countries, the policies to the poverty alleviation advocated both by the governments and donors consider the microfinance sector as one of the major tools to implement programs which contribute to poverty alleviation.

Despite the rapid development of the microfinance institutions (MFIs) in many developing countries, it is clear that entrusting the financing of development to private actors must not lead to exclude the government intervention as financial (Balkhenol and Gomez, 2002). The government intervention in the microfinance sector is justified not only in terms of equity between different categories of the population, but in terms of factor of development (Zeller and Meyer, 2002).

The central role of the government was highlighted as a solution to address market failures. Some microfinance experts wanted deregulation of financial systems, assumed that institutional financial stakeholders to adapt their practices to the needs of the poor. Others wanted the government itself takes care of the allocation of resources in this sector of the economy. But none of the two approaches addresses the issue. On the one hand, commercial banks prefer not to cover this segment of the market, because this type of customer has many risks. Grant loans to the poor are expensive for banks in terms of information search cost or hedging. However, the amounts lent do not justify such expenditures (Labie, 1996). On the other hand, there's no reason to think that the government can always better than the classical banking sector adapt to the characteristics of the market for credit to micro-enterprises (Stiglitz, 1988).

Prudential regulation governs the financial soundness of licensed intermediaries businesses, in order to prevent financial system instability and losses to small, unsophisticated depositors.

Prudential regulations are rarely applied in the microfinance sector, and they are imposed when several institutions are involved or for the protection of small depositors. In most developing countries, MFIs are not allowed to take deposits from the public. However, MFIs in many countries are subject to a non-prudential regulatory issues include consumer protection, fraud and financial crime prevention, interest rates policies, permission to land, tax and accounting discipline, etc. (see Armendariz and Morduch, 2010, chap8).

Christen, Lyman, and Rosenberg (2003), in their analysis of the principles of regulation and supervision in microfinance, highlight an important distinction between prudential regulation and non-prudential regulation. According to their definition, regulation is prudential when it is intended specifically to protect the entire financial system as well as to the safety of small depositors. The securities of microfinance institutions remain substantially lower than those of formal financial services providers, conventional commercial banks, and therefore do not pose a risk to the stability of the financial system in several countries. However, a growing number of microfinance institutions accepting deposits from the public, and many depositors are relatively poor. Ensure the safety of the depositors has reason to improve the regulation and supervision of microfinance institutions.

Microfinance involves making microcredit, i.e. small loans to large numbers of borrowers. As administrative costs (management) are proportionately higher for small loans (Helms and Reille, 2004), interest rates are necessarily much higher for MFIs than for conventional banks to cover all costs (funding cost and loan losses). Fortunately, capital returns can be high for small projects, and borrowers can pay high interest rates (see De Mel, McKenzie, and Woodruff, 2006, McKenzie, and Woodruff, 2007). At the same time, any factor that causes higher costs led MFIs to increase either the interest rates or the size of loan to maintain the same level of profitability. Increase interest rates or loan size should result excluding some poor borrowers. This situation explains the drift of MFIs in the accomplishment of their mission in the poverty alleviation (Armendariz and Szafarz, 2011).

We analyse the effects of regulations on the performance of MFIs and social welfare. Considering an MFI monopoly, which can manipulate interest rates to maximize its profit, we propose the implementation of regulatory policy that requires to the MFI to reduce its costs of funds and treatment management loans, subject to monetary compensation from the government. The MFI provides loans at an interest rate set by the government under the poverty alleviation program. It's an alternative to microfinance institutions: instead of raising interest rates to cover operating costs, they may choose to reduce costs through monetary compensation from the government. When MFIs can collect customer deposits or borrow from commercial banks (or central bank) to finance projects, the government can guarantee the stability of the financial system by imposing regulations to prohibit the remuneration deposits to MFIs. Indeed, the remuneration of deposits can lead to higher interest rate of on loans. In this context, we analyze how the objectives of stability of the interest rate and financial stability can be implemented in an economy characterized by the prohibition of paying interest deposits. We have thus developed a "smart subsidy" mechanism suggested by Morduch (2005), which contributes to economic and social development.

To our knowledge, such a policy of regulation of microfinance institutions has not yet been analyzed, and it would be interesting to compare this form of prudential regulation to other forms of non-prudential regulation. Indeed, many MFIs face certain forms of non-prudential regulation which may include rules governing the formation and operation of MFIs, consumer protection, fraud prevention, establishing credit information services, safety of transactions, limiting interest rates and tax and accounting issues (Christen, Lyman, and Rosenberg, 2003). In this paper, we analyse the optimal policies for regulating microfinance institutions, when the government is unable to observe the cost of fund management and processing of the loan portfolio (adverse selection) and the choice of the level of effort to improve the quality of services provided to customers for instance in monitoring, or selection of borrower project or other administrative tasks (moral hazard). The government can encourage the MFI to reveal his private information and choose the level of optimal effort through a reward rule applied based on a conditional grant by the announcement of the MFI. In the implementation of optimal contracts, the government faces a trade-off between the incentives for MFIs to the effectiveness and costs of the regulatory procedure in terms of informational rent to pay. We characterize the optimal mechanisms applicable in the context of two methods of allocating loans: funding with government funds and funding without government funds.

To this end, we propose a model that generalizes the classical model of regulation of a natural monopoly of Laffont and Tirole (1986) in the context of microfinance. Their model is a control problem under incomplete information in which the payment to the agent is based on an agent's performance indicator observed ex post by the principal. As in Laffont and Tirole (1986), we assume that marginal cost of effort is observed only outside the MFI and the final total cost is observed by the MFI and the government. We assume that the MFI support costs unlike Laffont and Tirole which assumes that the government reimburses the costs of the firm.

Employing techniques developed in the literature on the incentives theory and regulations (e.g., Laffont and Tirole, 1993), we derive the properties of the optimal regulatory policies of an MFI in the presence of a subsidy from the government. We show that the government intervention in microfinance can improve social welfare by reducing the financial constraints faced by MFIs and the poor. Therefore, it promotes economic development.

It is assumed that government intervention in the subsidy and regulation is socially costly. The fundamental problem of our model is the asymmetry of information that comes from the fact that the MFI has private information about its operating costs (adverse selection) and the

hidden actions that the MFI managers can undertake to increase the social welfare (moral hazard).

Our model can also be considered as an extension of models developed by Campbell, Chan, and Marino (1990), Laffont and Tirole (1993), and Giammarino, Lewis, and Sappington (1993).

The existing literature on microfinance has not paid much attention to the relationship between the MFI and the government. In contrast, there is a large amount of work examining the contracting between lenders and borrowers. This includes papers such as Ghatak and Guinnane (1999), Rai and Sjöström (2004) and Cull et al. (2009) among others. There are also a small number of papers focused on the relationship between the MFI and donors external. For example, Ghosh and Van Tassel (2011) (2013) consider only as asymmetric information the adverse selection on the relationship between the MFI and the donors. In our paper, we focus on the mixed model, combining adverse selection and moral hazard.

To highlight the issue of the poverty alleviation in the model, we assume that the financial regulator, which controls the level of the interest rates on loans, assigns a social value for loans. Concerning the participation of the MFI contract regulations, two cases are possible. In the first case, we assume that without the fund of the government, the MFI cannot finance any project and adopt a null level of effort. This case illustrates the fact that the MFI has necessarily an option external zero. In the second case, we consider that the external option may depend on the private information (see Jullien, 2000, Maggi and Rodríguez-Clare, 1995). This assumption allows us to show the gain (and sometimes the limits) of regulation beyond the ability of MFIs to finance some projects themselves.

The rest of this paper is organized as follows. In section 2, we describe the regulatory process as a game in terms of players and goals, and we give the results of first best. We characterize the optimal incentive contract under incomplete information in Laffont and Tirole (1986), adapting it to our framework of assumptions, in section 3. We consider some extensions of the basic model and we derive some policy implications, in section 4. Section 5 presents the different conclusions of the analysis.

2. The basic model and the benchmark case

2.1. The basic model

We consider the case of a credit market composed of government and donors which act as part of a program to the poverty alleviation, an MFI and a group of individuals each having a project to be financed. We suppose that the government provides a fund of an amount equal to G finance the program of the poverty alleviation, and donors are financing the programme for an amount equal to L . The amount of the financing of all loans is fixed equal to q . The MFI then has funds amounting $q = L + G$. Government, donors and MFI are risk neutral.

The nature of the projects is supposed to have been fixed before the signing of the contract between the government and the MFI, the decisions concerning the level of loan interest rates and terms of the contract that the government should conclude with MFI. We assume that a regulation to prohibit the remuneration of the funds is required to the MFI with the obligation to provide loans at a rate fixed by the government. The MFI monopoly therefore not given the opportunity to manipulate interest rates.

2.1.1 The MFI

We assume that at time t_0 , the MFI has an initial fund of an amount equal to $L + G$ that is used to finance loans q . We assume, without loss of generality, that $q = L + G$. The MFI provides loans that generate an overall return of rq at time t_1 where $r > 1$ is the average rate of return on all projects financed by the MFI. The net return on loans is influenced by the operating economies achieved by the MFI.

Now, let us denote by $C(\theta, e, q)$, the function of cost management of the all of fund and treatment of all loans $q = (q_1, \dots, q_n)$ (q is a vector of n loans). The function of cost depends on the parameter θ which is the positive constant marginal cost associated to a loan, cost θ is the sum of the operational and monitoring costs associated to a loan. The parameter θ is only known privately to the MFI. Then this creates a selection adverse problem between the MFI and the government. The function of cost depends, also, the parameter e as effort needed for monitoring or selection of borrower projects, finance advice, monitoring loan repayment, etc. This cost-reducing effort involves a disutility including the monetary equivalent will be supposed measure by an increasing and convex function $\varphi(e)$ (with $\varphi'(e) > 0$ if $e > 0$; $\varphi'(0) = 0$; $\varphi''(e) > 0 \quad \forall e$) for the MFI. The convexity of $\varphi(e)$, corresponds to the assumption that the effort is more expensive at the margin. Assume that MFI's effort is not observed by the government. The effort unobservability and costliness create a moral hazard problem between the government and the MFI.

The cost function $C = C(\theta, e, q)$ where θ an adverse selection parameter and e is a moral hazard variable has the following properties:

- (i) She is an increasing function of q : $\frac{\partial C}{\partial q_i} > 0$ for $i = 1, \dots, n$
- (ii) She is an increasing function of marginal cost θ : $\frac{\partial C}{\partial \theta} > 0$,
- (iii) She is a decreasing function of the level of effort e : $\frac{\partial C}{\partial e} < 0$.

Formally, the cost function is defined by

$$C(\theta, e, q) = (\theta - e)q, \quad (1)$$

where $\theta - e$ is interpreted as the MFI's cost inefficiency which is positive ($\theta - e > 0$).

The MFI is able to improve the quality of its loan portfolio if it devotes enough resources for this purpose, and in return the government pays a monetary compensation (a subsidy) noted by s to the managers of the MFI. The net gain on loan can be written by,

$$\pi(\theta) = s + rq - L - G - C(\theta, e, q) - \varphi(e),$$

using the expression of q , we have:

$$\pi(\theta) = s + (r - 1)q - C(\theta, e, q) - \varphi(e) \quad (2)$$

A fundamental feature of the model is the private information of the MFI on its marginal cost of processing transactions risky projects it finances.

Note here that the asymmetric information in this model concerns the type of MFI an adverse selection parameter which characterizes the efficiency of MFIs and moral hazard parameter which defines the level of effort made by the MFI managers.

By analysis and careful selection of projects it finances, the MFI can enhance the distribution of returns from its loan portfolio. More specifically, a low marginal cost is a signal of a high

quality management of the loan portfolio. The realization of the quality of the loan portfolio of the MFI is influenced by internal and external factors to the MFI (local economic conditions and the ability manage MFI managers), and importance of resources MFI has to improve the quality of loans (see Giammarino, Lewis, and Sappington, 1993). We suppose that the MFI interactions with borrowers to provide information on the MFI technological parameter and the level of effort that the regulator ignores. The MFI knows the exact level of its marginal cost, while the regulator considers this cost as a random variable on the interval $[\underline{\theta}, \bar{\theta}]$, $\underline{\theta} < \bar{\theta}$ with a distribution function $F(\theta)$ with positive density $f(\theta)$. We impose the regularity condition that $\frac{F(\theta)}{f(\theta)}$ is an increasing function of θ . This condition is commonly imposed in the private information agency literature.^b

2.1.2. The government's problem

The role of government is to promote the development of MFIs to reduce poverty. He leaves the profit MFIs and imposes a transfer s , possibly negative, that captures all or part of his informational rents. The contract specifies a monetary transfer s from the government to the MFI, the government agrees to pay immediately after the performance of the loan portfolio is materialized. This hypothesis in the context of the regulation of a private firm is justified by the role of government to the poverty alleviation. The government is considered here as a financial regulator, which controls the level of loans, and values them more strongly than MFIs.

We consider that the credits provide a positive externality in terms of poverty reduction.

Let $V(q)$, denote the reduced form of the social value of the loans programme q for the reduction of poverty, which is assumed to be increasing and concave in q , and $(1 + \lambda)s$ with $\lambda > 0$ the social cost of public funds, the net social welfare function is defined as:

$$W = E[V(q) - (1 + \lambda)s] \quad (3)$$

The monetary transfer from the government to the MFI depending on the announcement $\hat{\theta}$, the government must define the payment rule so that the manager of the MFI reveals the true value θ , choose the level of optimal effort and agrees to distribute loans.

Without loss of generality, we can modelize the regulation as a menu of contracts procedure $\{q(\hat{\theta}), r(\hat{\theta}), s(\hat{\theta})\}$ that the government presented to the MFI. The MFI is allowed to choose one of these options after observing the environment in which it is operating, that is, after observing the realization of its cost θ . The problem of the government is to maximize the expected social welfare, it is written by:

$$\max_{q, r, s} W(\theta) = \int_{\underline{\theta}}^{\bar{\theta}} [V(q) - (1 + \lambda)s(\theta)] f(\theta) d\theta \quad (4)$$

s.c.

$$\pi(\theta, \theta) \geq 0, \quad \forall \theta \in [\underline{\theta}, \bar{\theta}] \quad (5)$$

$$\pi(\theta, \theta) \geq \pi(\hat{\theta}, \theta), \quad \forall \theta, \hat{\theta} \in [\underline{\theta}, \bar{\theta}] \quad (6)$$

^b This condition is satisfied by many commonly used distributions such as Uniform, Normal, Exponential, and Gamma.

Inequality (5) describes the individual rationality constraint (it is also called participation constraint) for any type of MFI. This constraint ensures that the MFI needs to be at least compensated for the cost of the effort. Inequality (6) describes the incentive constraint, it identifies $\{q(\theta), r(\theta), s(\theta)\}$ as the contract that the MFI should select when its real marginal cost is θ , $\hat{\theta}$ being marginal costs announced by the MFI. The principle of revelation (Myerson, 1981) ensures that there is no loss of generality in represents the choice of the MFI in this way.

After analyzing the benchmark case of optimal regulation under complete information, in which the marginal cost and the effort can be observed and verified by the government, we characterize the optimal incentive contract under incomplete information.

2.2 Optimal regulation under complete information

In the absence of asymmetric information, the government is able to observe and verify the true cost of the MFI and its effort. Under complete information, the government could define the monetary transfer by saturating the individual rationality constraint of the MFI either (by normalizing the alternative profit to zero) setting $s = \varphi(e) + (\theta - e)q - (r - 1)q$, the problem of maximization of social welfare leads to the following proposition.

Proposition 1: *Under complete information, the optimal contract is characterised by a transfer $s = \varphi(e) + (\theta - e)q - (r - 1)q$, the government pays to the MFI an effort cost plus the difference between the cost total ex post and the rate of return of loans. The rate of return of loans is equal to the marginal cost, or $r - 1 = \theta - e$ the MFI exerted a level of optimal effort equalizing the marginal utility of effort and the marginal cost saving, that is:*

$$\varphi'(e) = q$$

A high level of effort reduces the overhead costs and the average rate of all loans, but increases the disutility of effort and therefore the necessary transfer to the MFI, and

$$\frac{d}{dq} [V(q) + (1 + \lambda)(r - 1)q] = (1 + \lambda)(\theta - e)$$

The social marginal value of the loan portfolio is equal to the marginal social cost.

3. Optimal regulation under incomplete information

Under incomplete information, using the principle of revelation, the government may be restricted to implement a significant direct mechanism such that the optimal strategy of the MFI which contains the announcement of real marginal cost θ . In other words, the MFI announces the true value of its parameter to the transfer rule s , and chooses the level of effort $e(\theta)$. The government faces to the problems of adverse selection and moral hazard. In general, adverse selection allows the MFI of appropriating an informational rent that the government should pay for the revelation of the true marginal cost. This rent is even higher that the parameter θ is low, the level of effort is to lower the level of perfect information. Following incentives theory (Laffont and Martimort, 2002), the optimal regulation can be obtained from the optimal truthful revelation mechanism.

Letting $\theta - e(\theta) = \frac{C(\theta)}{q(\theta)}$, denote the marginal cost, a revelation mechanism is described by a menu $\{q(\hat{\theta}), s(\hat{\theta})\}$ which depends on the announcement of the MFI $\hat{\theta}$ and satisfy the constraints (5) and (6). The situations of asymmetry of information and perfect information differ by the possibility the government to observe the ineffectiveness θ of the MFI. In both cases, the methodology considers in fact a pure adverse selection problem insofar as the control variables defined only depend on inefficiency, observable or not, of the MFI. In this case, defined by:

$$e(\theta) = \theta - \frac{C(\theta)}{q(\theta)}, \quad (7)$$

the level of effort required for an MFI of inefficiency θ to manage a portfolio of loan q at a cost C . Thus, operating costs and the cost of the effort no longer contain only a single unknown, inefficiency θ . From the expression of effort (7) and the prior expression of the profit of the MFI in (2), the profit of the MFI may be rewrite by

$$\pi(\hat{\theta}, \theta) = s(\hat{\theta}) + \left(r(\hat{\theta}) - 1\right)q(\hat{\theta}) - \left(\hat{\theta} - \theta + \frac{C(\hat{\theta})}{q(\hat{\theta})}\right)q(\hat{\theta}) - \phi\left(\hat{\theta} - \frac{C(\hat{\theta})}{q(\hat{\theta})}\right) \quad (8)$$

The problem of incentive becomes a simple problem of adverse selection relative to the parameter of adverse selection θ , the marginal cost $\frac{C}{q}$, the rate of interest r and the transfer s .

We now characterize the optimal incentive contract. Suppose that $\{q(\theta), r(\theta), s(\theta)\}$ satisfies the incentive constraint. Assuming $\pi(\hat{\theta}, \theta)$ differentiable, the incentive constraint is obtained at the end of two successive stages. At the first step, to ensure that the mechanism proposed by the government encourages the manager of MFI to announce his true efficacy, it is necessary that its announcement maximizes his utility when he told the truth.

To simplify the notation, let $z(\hat{\theta}) = \frac{C(\hat{\theta})}{q(\hat{\theta})}$ then $e(\hat{\theta}) = \theta - z(\hat{\theta})$, and

$$\phi(\hat{\theta}) = s(\hat{\theta}) + \left(r(\hat{\theta}) - 1\right)q(\hat{\theta}) - \left(\hat{\theta} - \theta + \frac{C(\hat{\theta})}{q(\hat{\theta})}\right)q(\hat{\theta})$$

The first-order condition is:

$$\left. \frac{\partial \pi(\hat{\theta}, \theta)}{\partial \hat{\theta}} \right|_{\hat{\theta} = \theta} = \left. \frac{\partial \phi(\hat{\theta})}{\partial \hat{\theta}} \right|_{\hat{\theta} = \theta} - \phi'(e(\cdot)) \left[\frac{\partial \theta}{\partial \hat{\theta}} - \frac{\partial z(\hat{\theta})}{\partial \hat{\theta}} \right] \Big|_{\hat{\theta} = \theta} = 0 \quad (9)$$

The first-order condition is sufficient if $\frac{\partial z(\theta)}{\partial \theta} \geq 0$. Note that $z(\theta) = \theta - e(\theta)$. This second-order condition can be written:

$$\frac{\partial e(\hat{\theta}|\theta)}{\partial \theta} - 1 = e'(\theta) - 1 \leq 0, \text{ thus } e'(\theta) \leq 1 \quad (10)$$

Equations (9) and (10) are necessary and sufficient conditions for the incentives mechanism.

At the second step, the rule of attribution of the rent to the MFI depending on the value of θ what it announces. If the MFI with a cost θ announces that its cost is $\hat{\theta}$, it must adopt the effort $e(\hat{\theta}|\theta) = e(\hat{\theta}) + \theta - \hat{\theta}$ to ensure a final cost equal to $C(e(\hat{\theta}|\theta), \theta) = \hat{\theta} - e(\hat{\theta})$. Thus, according to (9) or from the envelope theorem directly applied to expression (8), we obtain:

$$\frac{\partial \pi(\theta)}{\partial \theta} = -\phi'(e(\theta)) \left[\frac{\partial e(\theta)}{\partial \theta} \right] \Rightarrow \frac{\partial \pi(\theta)}{\partial \theta} = -\phi'(e(\theta)) \quad (11)$$

Thus, the rent is defined as the price that the government must pay for the effective types reveal their information. The mechanism encourage the manager of the MFI to reveal his true type, it must assign the highest rents to the most efficient MFIs and therefore the lowest for the least efficient MFIs. Consecutively to a decrease in the effort $\frac{\partial e(\theta)}{\partial \theta}$, the gain of the manager of the MFI in terms of utility is then equal to $\phi'(e(\theta)) \frac{\partial e(\theta)}{\partial \theta}$. The government shall guarantee the manager the same gain by paying a rent so that it announces its true type. By integrating equation (11), it gets the local incentive conditions

$$\pi(\theta) = \pi(\bar{\theta}) + \int_{\theta}^{\bar{\theta}} \phi'(e(\mu)) d\mu \quad (12)$$

From the rule by the incentive constraint, the individual rationality constraint becomes:

$$\pi(\bar{\theta}) = 0 \quad (13)$$

The equations (11) and (12) reflect the incentive terms of first and second order. Equation (11) shows that increasing the usefulness of the manager of the MFI when it lowers its marginal cost θ is equal to the marginal disutility of effort. Equation (12) defines the informational rent of the MFI.

As a result, using the methodology developed by Myerson (1981), Baron and Myerson (1981), and Laffont and Tirole (1986), we can write the objective of government (4) on the basis of the profit of the MFI when the optimal mechanism is used. Indeed:

$$\begin{aligned} W(\theta) &= \int_{\underline{\theta}}^{\bar{\theta}} \{V(q(\theta)) - (1 + \lambda)[\pi(\theta) - (r(\theta) - 1)q + C(\theta, e(\theta), q(\theta)) + \phi(e(\theta))]\} f(\theta) d\theta \\ &= \int_{\underline{\theta}}^{\bar{\theta}} \left[V(q(\theta)) - (1 + \lambda)[(\theta - e(\theta))q(\theta) - (r(\theta) - 1)q(\theta) + \phi(e(\theta))] - (1 + \lambda) \int_{\underline{\theta}}^{\theta} \phi'(e(\mu)) d\mu \right] f(\theta) d\theta \\ &\quad - (1 + \lambda)\pi(\bar{\theta}) \end{aligned}$$

$$\begin{aligned}
&= \int_{\underline{\theta}}^{\bar{\theta}} \left[V(q(\theta)) - (1+\lambda)[(\theta - e(\theta))q(\theta) - (r(\theta) - 1)q(\theta)] - (1+\lambda)\left[\phi(e(\theta)) + \frac{F(\theta)}{f(\theta)}\phi'(e(\theta))\right] \right] f(\theta) d\theta \\
&\quad - (1+\lambda)\pi(\bar{\theta})
\end{aligned} \tag{14}$$

after integrating by parts.

As the expected social welfare $W(\theta)$ is a decreasing function of $\pi(\theta)$, the individual rationality constraint $\pi(\bar{\theta})$ is equal to zero that is $\pi(\bar{\theta}) = 0$. The optimal contract is therefore the result of the maximization of the expected social welfare $W(\theta)$ (14) subject to (13). The resolution of this problem leads to the following proposition.

Proposition 2: For $\pi(\bar{\theta}) = 0$, the optimal contract is characterized by

$$(i) \quad \phi'(e^*(\theta)) = q(\theta) - \frac{F(\theta)}{f(\theta)}\phi''(e^*(\theta)), \tag{15}$$

$$\begin{aligned}
&\frac{\partial[V(q(\theta)) + (1+\lambda)(r(\theta) - 1)q(\theta)]}{\partial q(\theta)} = (1+\lambda)(\theta - e(\theta)) \\
(ii) \quad &+ (1+\lambda) \left[\frac{\partial \phi(e(\theta))}{\partial e} \frac{de(\theta)}{dq} + \frac{F(\theta)}{f(\theta)} \frac{\partial \phi'(e(\theta))}{\partial e(\theta)} \frac{de(\theta)}{dq} \right],
\end{aligned} \tag{16}$$

$$(iii) \quad s(\theta) = \phi(e(\theta)) + \int_{\underline{\theta}}^{\bar{\theta}} \phi'(e(\mu)) d\mu + (\theta - e(\theta))q(\theta) - (r(\theta) - 1)q(\theta) \tag{17}$$

Condition (15) ensures that the optimum level of effort under incomplete information is lower than the perfect information level. Condition (17) gives the value of the subsidy granted by the government to the MFI.

The analysis of this proposal is interesting insofar as the government tries to solve the problem of poverty by subsidizing microfinance institutions. Equation (17) shows that the transfer is higher in the absence of government funds in the loan program. The MFI adopts a low level of effort compared to that which it adopts in the presence of a government funding. Funding by the government led to an improvement of social welfare. However, the role of a government loan is very limited. A credit policy should be based on improving the organization and functioning of the credit market, reducing administrative costs, or by reducing the incentives to default.

4. Extensions: optimal regulatory policy in the presence of an option external non-zero

In this section, we consider an extension of the basic model by assuming that the benefit of reservation of the MFI can depend on private information (see Jullien, 2000, Maggi and Rodríguez-Clare, 1995) so that $\pi(\theta) \geq \pi_0(\theta)$ if the MFI refuses the contract, she gets a reservation profit equal to $\pi_0(\theta)$.

We assume that the government offers a contract to the MFI where verifiable variables are the transfer and loan volume. The MFI participates when she accepts the terms of the contract; She then chooses to distribute a volume of loans $q(\theta)$ and transfer $s(\theta)$. However, when the

MFI is excluded from the government program, it can finance itself projects. She should get the reservation profit.

Note by $\beta(\theta) \in \{0,1\}$ the probability that the MFI type θ participates in loan program of government. Suppose that the loan contracts are non-stochastic $\beta(\theta)$ takes value 0 or 1, and if the MFI type θ participates, it distributes a volume of loans $q(\theta)$ with probability 1.

Following the revelation principle, a contract can be represented by a menu $\{q(\theta), r(\theta), s(\theta), \beta(\theta)\}$, such that the MFI's best choice within the menu is to announce its true type θ (incentive constraint) and that she receives a profit greater than the reservation profit $\pi_0(\theta)$ (individual rationality constraint). Either $\pi(\theta)$ the profit obtained by the MFI when its type is θ :

$$\pi(\theta) = \beta(\theta)[s(\theta) + (r(\theta) - 1)q(\theta) - C(\theta, e(\theta), q(\theta)) - \phi(e(\theta))] + (1 - \beta(\theta))\pi_0(\theta) \quad (18)$$

The net social welfare function is defined as:

$$W(\theta) = E\{\beta(\theta)[V(q(\theta)) - (1 + \lambda)s(\theta)]\}$$

Finally, the regulator's maximization program is written:

$$\max_{q, s, \beta} W(\theta) = \int_{\underline{\theta}}^{\bar{\theta}} \beta(\theta)[V(q(\theta)) - (1 + \lambda)s(\theta)]f(\theta)d\theta \quad (19)$$

s.c.

$$\pi(\theta) \geq \pi(\hat{\theta}) + C(\hat{\theta}, e(\hat{\theta}), q(\hat{\theta})) - C(\theta, e(\hat{\theta}), q(\hat{\theta})), \quad \text{if } \beta(\hat{\theta}) = 1, \quad \forall \theta, \hat{\theta} \in [\underline{\theta}, \bar{\theta}] \quad (20)$$

$$\pi(\theta) \geq \pi_0(\theta), \quad \forall \theta \in [\underline{\theta}, \bar{\theta}] \quad (21)$$

$$\pi(\theta) = \pi_0(\theta), \quad \text{if } \beta(\theta) = 0, \quad \forall \theta \in [\underline{\theta}, \bar{\theta}] \quad (22)$$

Equation (20) represents the incentive constraint, where $s(\hat{c})$ is replaced by $\pi(\hat{\theta}) - (r(\hat{\theta}) - 1)q(\hat{\theta}) + C(\hat{\theta}, e(\hat{\theta}), q(\hat{\theta})) + \phi(e(\hat{\theta}))$. Equation (21) is the individual rationality constraint. Equation (22) imposes that the excluded MFI of the program receives the reservation profit.

A regulatory mechanism $\{q(\theta), r(\theta), s(\theta), \beta(\theta)\}$ is feasible, if it satisfies the constraints (20), (21) and (22).

From a classical result of incentives theory (see e.g., Salanié, 1998), the incentive constraint is verified if and only if π is absolutely continuous and verifies the first-order and second-order conditions ensuring that the truth-telling is an optimal strategy for the MFI. It should be noted here that these conditions are sufficient only when there is full participation and individual rationality holds (Jullien, 2000). When exclusion is allowed, they are still verified on the participation set but not suffice to ensure global incentive. According the results of section (3), the incentives of the first order condition is given by

$$\pi'(\theta) = -\phi'(e(\theta))$$

To characterize the optimal contract when the reservation profit of the MFI may depend on its type, we can consider two cases: the non-prudential regulation and prudential regulation. In both cases, we assume that a regulation prohibiting the remuneration of deposits is necessary to MFIs with the corresponding obligation to accept deposits.

4.1. The optimal regulatory contract in a model without exclusion

Consider the framework of a simple principal-agent model without exclusion. In this context, the MFI receives $\pi_0(\theta) = -\varphi(\theta)$ for all θ and $C = C(\theta, e, 0) = 0$. In this case, must be $\pi'(\theta) - \pi'_0(\theta) = -\varphi'(e(\theta)) + \varphi'(\theta) \leq 0$ and therefore, individual rationality is satisfied everywhere if it wishes to $\theta = \bar{\theta}$. The individual rationality constraint is equal to $\theta = \bar{\theta}$. Given that $\pi(\theta) = \pi_0(\bar{\theta}) + \int_{\bar{\theta}}^{\theta} \varphi'(\mu) d\mu$ the objective function of the government can still be written:

$$W = \int_{\underline{\theta}}^{\bar{\theta}} \left[V(q(\theta)) - (1+\lambda)((\theta - e(\theta))q(\theta) - (r(\theta) - 1)q(\theta)) - (1+\lambda)\left[\varphi(e(\theta)) + \frac{F(\theta)}{f(\theta)}\varphi'(e(\theta))\right] \right] f(\theta) d\theta - (1+\lambda)\pi_0(\bar{\theta}) \quad (23)$$

The optimal contract is therefore the result of the maximization of (23) under the constraint $\pi(\bar{\theta}) = \pi_0(\bar{\theta}) \neq 0$. The resolution of this problem leads to the following proposition.

Proposition 3: For $\pi(\bar{\theta}) = \pi_0(\bar{\theta}) \neq 0$, the optimal contract is characterized by:

$$(i) \quad \varphi'(e^*(\theta)) = q(\theta) - \frac{F(\theta)}{f(\theta)} \varphi''(e^*(\theta)), \quad (24)$$

$$(ii) \quad \frac{\partial[V(q(\theta)) + (1+\lambda)(r(\theta) - 1)q(\theta)]}{\partial q(\theta)} = (1+\lambda)(\theta - e(\theta)) + (1+\lambda) \left[\frac{\partial \varphi(e(\theta))}{\partial e} \frac{de(\theta)}{dq} + \frac{F(\theta)}{f(\theta)} \frac{\partial \varphi'(e(\theta))}{\partial e(\theta)} \frac{de(\theta)}{dq} \right], \quad (25)$$

$$(iii) \quad s(\theta) = \pi'_0(\bar{\theta}) + \varphi(e(\theta)) + \int_{\bar{\theta}}^{\theta} \varphi'(\mu) d\mu + (\theta - e(\theta))q(\theta) - (r(\theta) - 1)q(\theta). \quad (26)$$

We obtain the standard result when the probability that the MFI participates in the program financed by the government is equal to 1 ($\beta(\theta) = 1$). Social marginal utility on lending activity is equal to the marginal social cost (equation (25)). The equation (26) shows that the transfer to the MFIs is higher than in the case of an option external zero (equation (17)). However, we can verify on the equations (15) and (24) that the MFI should adopt the same level of effort in both cases.

4.2 Prudential regulation of the MFIs without compensation of deposits

Consider an MFI with a capacity to finance some projects without the help of the government. Suppose that the cost of the MFI function is given by $C(\theta, e, q) = (\theta - e)q(\theta, r)$, with $q(\theta, r)$ demand for credit to the MFI. The MFI can be manipulates interest rates and various contracts to maximize his profit, we assume that when the IMF increased its credit rate, the credit demand fall:

$$-\frac{\partial q}{\partial r} > 0 \quad (27)$$

As in the basic model, we assume that the government fixes the interest rate, and offers to the MFI to apply this rate to the poor, and he encouraged him to reduce costs through monetary compensation.

Suppose that the MFI offers at the same time deposit products. We assume that the elasticity of demand for deposits at the credit interest rate is zero. This assumption reflects the fact that depositors cannot keep their deposits in them. Let D the demand deposit for the MFI, we analyse how the objectives of stability of prices and financial stability can be implemented in an economy characterized by the prohibition of remuneration of deposits (Bensaid and De Palma, 1995) and we characterize the optimal regulatory policy.

When the MFI grants an amount of loans $q(r)$ and deposits for an offer amount D , prudential regulation requires it to establish reserves for an amount R . Let S be the cash balance which can be positive or negative is funded on the interbank market. We suppose, without loss of generality, that the capital of the MFI is zero, the cash-flow is then:

$$S = R + q - D \quad (28)$$

The rate of refinancing of this cash-flow is ensured at a constant rate noted by ρ offer by the Central Bank. To simplify the analysis, we consider only instruments of monetary policy, the refinancing rate and coefficient of reserves that we note κ ($R = \kappa D$). Thus, the profit of the MFI is written:

$$\begin{aligned} \pi(\theta) = & \beta(\theta)[s(\theta) + (r(\theta) - \rho)q(\theta) + ((1 - \kappa)\rho - 1)D \\ & - C(\theta, e(\theta), q(\theta)) - \varphi(e(\theta))] + (1 - \beta(\theta))\pi_0(\theta) \end{aligned} \quad (29)$$

The regulator needs to solve the following program to obtain the optimal regulatory policy:

$$\max_{q, r, s, \beta} W(\theta) = \int_{\underline{\theta}}^{\bar{\theta}} \beta(\theta) [V(q(\theta) - (1 + \lambda)s(\theta))] f(\theta) d\theta \quad (30)$$

s.c.

$$\pi(\theta) \geq \pi(\hat{\theta}) + C(\hat{\theta}, e(\hat{\theta}), q(\hat{\theta})) - C(\theta, e(\hat{\theta}), q(\hat{\theta})), \quad \text{if } \beta(\hat{\theta}) = 1, \quad \forall \theta, \hat{\theta} \in [\underline{\theta}, \bar{\theta}] \quad (31)$$

$$\pi(\theta) \geq \pi_0(\theta), \quad \forall \theta \in [\underline{\theta}, \bar{\theta}] \quad (32)$$

$$\pi(\theta) = \pi_0(\theta), \quad \text{if } \beta(\theta) = 0, \quad \forall \theta \in [\underline{\theta}, \bar{\theta}] \quad (33)$$

$$R \geq \kappa D \quad (34)$$

We can now state the result in the following proposition:

Proposition 4 : For $\pi(\bar{\theta}) = \pi_0(\bar{\theta}) \neq 0$, when MFI may collect customer deposits without compensation, optimal prudential regulation policy is characterized by:

$$(i) \quad \phi'(e^*(\theta)) = q(\theta) - \frac{F(\theta)}{f(\theta)} \phi''(e^*(\theta)), \quad (35)$$

$$(ii) \quad \frac{\partial[V(q(\theta)) + (1+\lambda)(r(\theta)-1)q(\theta)]}{\partial q(\theta)} = (1+\lambda)(\theta - e(\theta)) \quad (36)$$

$$+ (1+\lambda) \left[\frac{\partial \phi(e(\theta))}{\partial e} \frac{de(\theta)}{dq} + \frac{F(\theta)}{f(\theta)} \frac{\partial \phi'(e(\theta))}{\partial e(\theta)} \frac{de(\theta)}{dq} \right],$$

$$(iii) \quad s(\theta) = \pi'_0(\bar{\theta}) + \phi(e(\theta)) + \int_{\theta}^{\bar{\theta}} \phi'(e(\mu)) d\mu + (\theta - e(\theta))D \quad (37)$$

$$-(r(\theta) - \rho)D - ((1 - \kappa)\rho - 1)D$$

By comparing equation (37) with (26) and (17), we have a following result: For the same amount of loans, the monetary transfer is lower than other forms of regulations. In addition, for the same level of effort, the social welfare is higher.

We considered a prudential regulation to prohibit the remuneration of deposits by the MFI with the obligation to accept deposits. This obligation is expensive for MFIs if the management of the accounts presents operating costs. This hypothesis is that we have adopted here in generalizing the basic model.

When the remuneration of deposits is prohibited, the profit of the MFI that accepts deposits is modified from the expression (18). The level of effort of equilibrium is unchanged since the amount of distributed loans is always the same.

5. Conclusion

In this paper we developed a new theory of the regulations for the sector of microfinance institutions so that they can ensure his two missions: the sustainability of institutions and the poverty alleviation.

We were able to highlight the effects of regulation on the performance of MFIs and social welfare. Despite the high information asymmetry between the regulator in this case the government and the manager of microfinance institution, we have established an incentive mechanism of assigning a monetary compensation to the effective microfinance, this allows it to reduce its management costs funds and processing of the loan portfolio. The MFI can therefore lend at reasonable interest rates to the poor. This incentive mechanism can be considered as a "smart subsidy" mechanism that contributes to the economic and social development.

To our knowledge, such regulatory policy has not yet been analyzed in the microfinance sector. We also performed a comparative study of this form of regulation to other forms of non-prudential regulation. Indeed, many MFIs face certain forms of non-prudential regulation which may include rules governing the formation and operation of MFIs, consumer protection, fraud prevention, establishing credit information services, security of transactions, limitation interest rates, and tax and accounting issues.

Finally our results showed that when the MFI is in the presence of an option external non-zero, the prudential regulation is preferable to a non-prudential regulation for the same loan amount. This theoretical result could not be highlighted in the existing empirical literature (cf. e.g. Christen, Lyman, and Rosenberg 2003) because it relies on the assumption that the remuneration of deposits is prohibited. Under this hypothesis, we show that the profit of the MFIs that accepts deposits, adopts the same level of effort to equilibrium since the amount of loans disbursed is still the same, but its financial performance is significantly reduced. Although these results highlight the benefits of prudential regulation of MFIs in terms of protection of depositors and stability in the microfinance sector, the issue of prudential regulation of MFIs in developing countries remains open both empirical and theoretical.

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